

## ETHANOL: A STRATEGIC ENERGY SOURCE?

BY

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USAWC PROGRAM RESEARCH PROJECT

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by

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Topic Approved By:  
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## ABSTRACT

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As an element of our energy security policy, the United States should encourage the development of alternative energy sources for future U.S. energy needs. The present administration cites our dependence on oil as one of our critical national weaknesses. Our international standing and economic stability would be improved if we can discover plentiful renewable energy sources that eventually reduce global demand for oil. Ethanol is one of several possibilities for achieving energy security, especially as it applies to transportation fuels.

This project examines the viability of ethanol to serve as this alternative fuel source. It will compare the current sources of ethanol, compare their economic and environmental viability, and assess these impacts on American energy security strategy. It then will determine whether there are significant benefits to energy security from ethanol production, and what adjustments in current policies can make ethanol and other energy sources viable alternatives to oil.

## ETHANOL: A STRATEGIC ENERGY SOURCE?

Energy security is critical to U.S. national security. This paper will analyze ethanol as one of the possible methods of obtaining, if not energy self-sufficiency, at least some level of energy source stability. The economic shock of four dollar per gallon gasoline in 2008 demonstrated how critical reliable fuel supplies can be. Energy security is one of the top priorities of the administration.<sup>1</sup> President Obama stated in his inaugural address, "Each day brings further evidence that the ways we use energy strengthen our adversaries and threaten our planet."<sup>2</sup> Others put the effects of our current energy policy more bluntly. Thomas Friedman in *Hot, Flat and Crowded* posits that, "Ending our oil addiction is not simply an environmental necessity anymore. It's a strategic imperative...Our addiction to oil makes global warming warmer, petrodictators [sic] stronger, clean air dirtier, poor people poorer, democratic countries weaker, and radical terrorists richer."<sup>3</sup> This research project examines the viability of ethanol as an alternative fuel source. It will identify whether an ethanol-focused alternative energy program represents the best use of our national resources given the range of alternatives. Next, it will identify and test the common arguments for and against ethanol adoption, compare economic and environmental viability, and assess the impact of these factors on our energy security strategy. Finally, this study concludes with policy recommendations to adjust our current energy strategies to break our dependence upon oil and support U.S. national interests.

Energy is the lifeblood that drives the body of our contemporary life. "Terrorism doesn't threaten the viability of the heart of our high technology lifestyle, but energy really does."<sup>4</sup> Our dependence on foreign oil has hidden costs. A notable portion of our

defense budget goes to maintaining safe transit routes for the movement of oil, and equipment and training support for major oil producing nations.<sup>5</sup> To enhance national security, we must have energy security. "Self-sufficiency has a value greater than even the largest army."<sup>6</sup> However, our efforts to achieve this security are counterpoised against world and national trends.

Worldwide, there is a growing demand for oil that the current recession has just delayed. The International Energy Agency (IEA) projects that by 2012, surplus oil production capacity will completely disappear, and by 2015, shortages could reach 10 million barrels per day (mbbl/d).<sup>7</sup> Currently, the world's daily oil needs are 86 mbbl/d.<sup>8</sup> World oil demand has increased seven mbbl/d since 2000.<sup>9</sup> IEA estimates that the world's energy needs will be almost 50 percent higher in 2030 than they are now; to 118 mbbl/d.<sup>10</sup> This demand will mostly come from developing countries, particularly China and India, with massively expanding economies, populations and expectations.<sup>11</sup> The days of cheap oil are waning.

In addition, rising demand is not being met by increased oil production development. Nationally owned companies control 80 percent of the world's known oil reserves.<sup>12</sup> Nationalized energy companies have their profits drawn off to benefit political constituencies, rather than to develop wealth maximizing production infrastructure improvements. Even if infrastructure for these additional needs begins today, it will be ten years before production catches up with expected demand.<sup>13</sup> The inability to meet energy demands can drive countries to desperate measures. Imperial Japan in 1941 went to war to secure its energy supplies. The United States must

prepare for these shortages if we are to maintain our economic strength and leadership role in the world.

To add to the importance of the situation to the nation, the majority of world oil supplies come from dictatorships, unstable or rogue states or nations with anti-modern, anti-Western goals.<sup>14</sup> As oil prices rise due to increasing demand - an economic certainty - the transfer of wealth from modern nations to these states will be ever accelerating. With earnings far in excess of their budgets, these nations have the ability to act against the U.S. interests, their neighbors and their own people. They most certainly will use their derived power to influence international events to their interests, which are likely at odds with our foreign policy. Diversification of supply can help alleviate our dependence on dictatorial or rogue states. However, as we seek other sources, we will be in direct competition with numerous states that are also seeking a lifeline to an ever-shrinking oil supply.

Furthermore, the United States is highly addicted to petroleum. We consume 25 percent of world oil production, yet control less than three percent of the supply.<sup>15</sup> We use about 69 mbbbl/d of oil to lubricate our economy. In 2006, the U.S imported 40 mbbbl/d for about 58 percent of its oil needs. A significant portion, 6.8 mbbbl/d or 17 percent of that amount was shipped from the Middle East.<sup>16</sup> An additional 1.5 mbbbl/d or 11 percent comes from Venezuela.<sup>17</sup> Projections show that the United States will increase oil imports to 67 million barrels per day, or 70 percent of its needs by 2020.<sup>18</sup> Without a concerted effort, our appetite for oil will continue to grow unabated.

The majority of this addiction is used for vehicle transportation. Fully two thirds of U.S. oil consumption and half of global oil consumption produced gasoline and diesel



fuels for cars and trucks.<sup>19</sup> For our nation, this translates to 46 mbbl/d, more than amount of oil that we import. This fact is important as we develop our energy policies.

Since automobile and truck use comprises a large portion of our current petroleum usage, changes in demand has a large impact on our oil needs. The recent gasoline price surge to \$4 per gallon caused a corresponding decrease in gasoline use and miles driven on our highways. This follows the basic economic principle of supply and demand. Oil is considered an inelastic good in the short run on both the supply and demand curves, because it is a necessity and there are few substitutes. Inelasticity means that a change in price will cause only a small change in quantity demanded, but the opposite applies for demand changes: small declines in demand or small increases in supply can trigger large price reductions.<sup>20</sup> This is what occurred when U.S. consumers changed their behavior and started driving less, causing a glut on the world oil market and driving the price down to below \$1.50 per gallon in late 2008. Consumer behavior affected the demand for oil more than any government program. This point is important as we analyze the existing market and our present energy policies to determine if ethanol is part of the solution.

The United States and Brazil together account for 88 percent of world ethanol production, but Brazil enjoys a natural competitive advantage. The primary ethanol source crops are sugar cane and corn. Brazil has a competitive advantage for the production of ethanol due to warmer climate and the use of sugar cane as the primary ethanol source crop. The Brazilian government also invested billions to subsidize ethanol products and to spur technological development in the field. Brazilian ethanol is six times cheaper to produce than U.S. corn ethanol.<sup>21</sup> Due to climate limitations, the

only states in America that can successfully grow sugar cane are Hawaii, Texas, Louisiana and Florida, so the majority of ethanol in the United States comes from corn. The price of corn constitutes 70 percent of U.S. ethanol costs.<sup>22</sup> Most sources acknowledge that corn is not an efficient source of ethanol, for both economic and environmental reasons. But continued ethanol production is only viable if there is a demand.

The potential market looks promising in the short term. Consumers currently use ninety-nine percent of ethanol produced in the 10 percent ethanol/ 90 percent gasoline market. In 2006, the United States consumed 140 billion gallons of gasoline. Vehicles can handle a ten percent blend, so there is already a potential current market capacity of 14 billion gallons a year without any vehicle fleet modifications.<sup>23</sup> Our national ethanol production from 2007 to 2008 went from 6.8 billion gallons to 9 billion gallons, so there is still room for growth, but this market will become saturated in a few years.<sup>24</sup> The Department of Energy (DOE) projects that growth in demand for renewable fuels will increase by 3.3 percent per year, which is well above the estimated 1/2 percent growth of the overall energy market.<sup>25</sup> Future production of flex-fuel vehicles and the possible adoption of higher ethanol content in electrical generation bode well for increased demand. With this background, we can review U.S. policies that encourage alternative fuel development.

The administration's "New Energy for America Plan" includes several sub-items which will drive the United States to an alternate fuel source. These include: increase fuel efficiency standards, get 1 million plug-in hybrid cars on the road by 2015, create a new \$7,000 tax credit for purchasing advanced vehicles, establish a national low carbon

fuel standard, ensure 10 percent of our electricity comes from renewable sources by 2012, and deploy the cheapest, cleanest energy source.<sup>26</sup> These active government policies are focused for the most part on shaping consumer decisions to decrease our use of oil while increasing the demand for gasoline alternatives. They also maintain a rational policy of looking at all energy alternatives, without favoring a particular source.

Further goals found in the Energy Independence and Security Act (EISA) of 2007 affect the adoption of ethanol and other alternative fuels. EISA sets a mandatory Renewable Fuel Standard requiring the use of at least 36 billion gallons of biofuel in 2022. Another objective is to reduce gasoline use by 20 percent by 2017. EISA also sets two target dates for cellulose ethanol.<sup>27</sup> By 2012, they want to develop technological breakthroughs to make cellulosic ethanol cost competitive (\$1.33 per gallon) with corn-based ethanol. By 2017, EISA wants to advance further progress that will drive down production costs to \$1.20 per gallon by 2017.<sup>28</sup>

New laws also encourage alternative energy development. The recently passed American Recovery and Reinvestment Act (ARRA) of 2009 will also spur ethanol production and research and development (R&D) efforts. It provides \$800 million for the Biomass Program, which funds ethanol R&D and demonstration projects. ARRA provides \$6 billion in loan guarantees for renewable energy projects, and extends tax credits for ethanol production facilities through 2013. Producers receive grants up to 30 percent of building costs.<sup>29</sup> ARRA also provides \$510 million to commercialize cellulosic ethanol production, and \$300 million in grants to alternative fueled vehicle pilot programs.<sup>30</sup> The Department of Agriculture (DOA) recently called on the Environmental Protection Agency (EPA) to allow an immediate increase in the ethanol limit in gasoline

to 12 or 13 percent.<sup>31</sup> A further review of the ethanol industry will allow us to see how these policies affect our ability to obtain energy security.

Cost comparisons are helpful in evaluating whether the United States can produce ethanol competitively as an alternative to oil. Using present American production methods, ethanol is price competitive when gasoline is at or above \$2.50 per gallon or at about \$75-80 a barrel of oil.<sup>32</sup> Oil currently sells for about \$51 a barrel. A comparable 42-gallon barrel of United States produced corn ethanol is about \$54 a barrel.<sup>33</sup> Therefore, American produced ethanol cannot presently compete against the lower priced gasoline.

But as stated earlier, the United States is not the only country producing ethanol. Brazil uses sugar cane as the source of their production. It is cheap to grow, harvest and convert, so Brazilian ethanol is only 75 cents per gallon, or \$31.50 a barrel.<sup>34</sup> In 2007, Brazil exported 160 mbbl to America, because U.S. corn ethanol production could not keep up with demand. Ethanol, like oil, is a commodity, so the consumer does not care about the source; just that it comes at the lowest price. With the professed U.S. government policy of encouraging the substitution of gasoline with ethanol, it appears from this analysis that importing Brazilian ethanol would be the most economical and prudent answer to our energy needs. Politics complicates this solution.

The political twist is the protectionist tariff that effectively bars foreign imports of ethanol.<sup>35</sup> Currently, there is a 2.5 percent plus 54 cents a gallon tariff, or about 22 dollars a barrel, on any imported ethanol.<sup>36</sup> In contrast, we have a 1.25 cent a gallon tariff on crude oil from Saudi Arabia. Lifting the ethanol tariff was a major talking point of Brazilian President Lula Da Silva in his visit to the White House on 14 March 2009.

President Obama acknowledged that, “I know that the issue of Brazilian ethanol coming into the United States has been a source of tension between the two countries.”<sup>37</sup>

However, he was very specific in not promising any changes to this policy.

The United States also provides a 51 cents a gallon direct subsidy for domestic ethanol production, or about 21 dollars a barrel. In addition, there are numerous indirect and supply chain subsidies. The government uses grant guarantees, reduced tax rates, loans below private sector rates, and insurance to encourage ethanol production and drive up the overall subsidy to \$1.38 per gallon.<sup>38</sup> Many of these programs are open-ended, so the more ethanol domestic firms produce; the more subsidies they receive. Overlapping programs enable private companies to pocket taxpayer dollars up to \$6.8 billion a year.<sup>39</sup>

Another issue is the use of available farm land to produce energy crops. Some groups criticize the use of ethanol as an alternative on the grounds of limited availability of American cropland and a corresponding increase in food prices. They argue against the conversion of domestic cropland from food to energy use, especially if corn is used as the ethanol source.<sup>40</sup> These evaluations are appropriate given our current focus on corn ethanol and its current yield. Tripling yields can make corn-based ethanol production economically feasible, but current yield trends are only increasing at about one percent a year.<sup>41</sup> Seventeen percent of our corn crop goes to ethanol production, but it only accounts for one percent of our fuel demands.<sup>42</sup> A consortium of environmental groups state that corn ethanol production can only provide 15 percent of U.S. transportation fuel needs, even if all current corn production was used for ethanol.<sup>43</sup> Subsidies entice farmers to plow up former grasslands to produce more corn

and not plant wheat and other crops, which they say drive up food costs. As more corn is taken out of the international grain market to convert to fuel, it could create food shortages across the globe.

Other groups contend that there is currently no relationship between rising food prices and cropland conversion to meet ethanol demand. Corn prices did double from 2005 to 2007, a concern since the United States provides 70 percent of corn exported around the world, but overall food costs remained below historical averages.<sup>44</sup> Land conversion also seems to be an arguable point. Several studies estimate that the United States will need to devote 50 to 112 million acres to biofuels to meet our transportation fuel needs.<sup>45</sup> The United States currently has 350 million acres under cultivation. The agricultural industry uses 250 million of those acres to grow food for animals, not for humans. There are an additional 40 million acres in the Conservation Reserve Program in which we pay farmers about \$48 per acre to not grow crops.<sup>46</sup> Arable land within America does not seem to be a critical issue.

A third potential problem with current ethanol production in America is the use of a significant amount of pesticides, oil derived fertilizers and other non renewable inputs.<sup>47</sup> Any modern crop has these drawbacks, but these methods have increased yields over the decades, so this is not a strong criticism. Stronger arguments arise from a discussion of energy balance. Various sources estimate that corn ethanol production either uses more energy than is produced or at least uses a large amount of energy per gallon created.<sup>48</sup> This does not bode well for corn as a candidate to ensure our energy security.

The United States must resolve other items before ethanol can be a workable gasoline substitute. The first issue is lack of infrastructure. Infrastructure issues such as distribution systems and stations capable of dispensing ethanol will require significant investments. Due to ethanol's chemical propensity to absorb water, the nation must establish duplicate transportation and pipeline systems. It is also estimated that ten percent of service stations must be flex fuel capable before the general public would be willing to accept flex fuel vehicles for travel.<sup>49</sup> Currently, there are only 269 of these stations in operation. It costs as much as \$80,000 to retrofit a station with E85 (85 percent ethanol) pumps.<sup>50</sup> This translates to a billion dollars to convert ten percent of the gas stations across America to E85.<sup>51</sup> The DOE is currently selecting regions and cities to start developing infrastructure for the E85 program, but the fuel itself must be below the cost of gasoline for the majority of the public to adopt this fuel.

The second issue is foreign influence on petroleum prices. Some authors contend that attempts to create a feasible alternative energy program will be undermined by the oil cartels and government-owned oil companies seeking to maintain their influence over the major energy consuming countries. They can do this by increasing supply to drive down oil prices, so the nascent energy industries cannot compete. The history of the last 40 years shows that Congressional action on energy policy recedes as prices abate.<sup>52</sup> Federal funding for energy technology research also follows this trend.<sup>53</sup> While this threat is a possibility, it would take unusual internal discipline within OPEC to maintain prices low enough to cripple alternative energy development. They want to maximize their wealth while maintaining a global economy that will guarantee their continued funding streams. A more likely scenario is that market

forces will continue to keep the price of oil below the break-even point for ethanol to be economically practicable.

Third, by embracing a plant-based energy solution, we are actually exchanging geopolitical risk with supply/yield risk. Oil is easily and consistently extracted, transported, and used throughout the world. In spite of political differences, the monetary advantages to both oil buyers and sellers provide powerful incentives to keep a steady supply going. Crop yields, however, are dependent upon weather. Historically, we can expect yields to drop by 11.9 percent in a given year, and have a 31.8 percent decline once in a 20-year period.<sup>54</sup> These supply shocks could have more negative effects upon the economy than any earlier oil embargo.

Fourth, others oppose the use of ethanol for market-based reasons. They state that the government should not spend billions of dollars on or choose a particular fuel alternative over other options. If ethanol never proves to be a workable alternative to oil, we will have wasted a vast amount of resources for nothing. Current ethanol policies provide government backing to cover private risk. Farmers and ethanol producers reap huge monetary gains through numerous government subsidies, while little true demand is created in the market.<sup>55</sup> They recommend that unless ethanol becomes a self-sustaining industry in the near future, resources should be shifted to more practical alternatives.

Finally, long-term trends in transportation seem to point away from liquid fuels and toward electricity as the logical alternative to oil.<sup>56</sup> Ethanol, at least given the current status of the industry in America, is only a bridge solution to oil dependency. It is of



limited utility to develop an energy source that will not be accepted by the market and will soon be overtaken by other technologies.

With so many risks and drawbacks, America must consider the adoption of ethanol as a possible alternative energy source carefully. We must weigh policy measures against their third order effects and opportunity costs before they are adopted. With the above comparisons of the advantages and disadvantages of ethanol, the United States should establish a prudent yet politically acceptable set of policies to best meet our national interests. An honest assessment is needed.

Our current reliance on corn ethanol with protectionist policies is not a feasible solution in our effort to reduce our reliance on oil. If we want to truly continue to explore the possibilities of ethanol as a valid replacement, we must eliminate the current self-defeating policies. At the same time, the administration should adopt other controls which will not only encourage development of other sources of ethanol, but all other reasonable sources of alternative energy. Here are options that we need to take to have a legitimate ethanol and energy policy.

First, reduce and eventually eliminate the tariff on imported ethanol. The U.S. ethanol industry has received subsidies since 1978 and is considered mature by the Energy Information Administration.<sup>57</sup> Establish a phase out date of all tariffs in the mid term, perhaps 2012, to coincide with other DOE ethanol goals. This would be especially effective if we entered into a trade partnership with Brazil and other Caribbean countries that have a natural competitive advantage to produce the shortfalls in U.S. ethanol production. Especially in Brazil's case, exchanging a friendly democracy for hostile petroleum suppliers is both economically and politically prudent. Since current demand

exceeds our domestic ability to supply, additional imports to make up the difference will not hurt our local producers. It will also accomplish a market objective of making ethanol price competitive.

Groups with vested interests in the program, such as the National Farmers Union and the Renewable Fuels Association will vigorously resist eliminating tariffs. Lower priced imports will drive the overall sales price down, making American ethanol production less profitable. There are other problems. The American Sugar Alliance claims numerous other countries have tariffs to protect their domestic production from Brazilian sugar, because Brazil heavily subsidizes their ethanol producers.<sup>58</sup> To mitigate these issues, we should negotiate a like reduction in the internal subsidies Brazilian ethanol receives from their government. The tariff phase out, with a definitive end date will allow domestic producers time to improve their ethanol production processes to make it competitive on the open market.

There is precedence for lifting sugar import tariffs. The North American Free Trade Agreement already allows Mexican sugar to enter the U.S. tariff free. As noted earlier, there is enough current market capacity to absorb all American ethanol production and a large share of Brazil's for the next few years. This will lower the overall price at the pump, and make ethanol a viable alternative to consumers.

Next, develop a variable subsidy program for ethanol to guarantee that its price will be competitive with gasoline, yet link it to a sliding downward scale as the market price of oil goes up. This is a departure from the current ethanol subsidy program, which is a linear scale that matches production capacities or consumption levels. Current subsidies do not decline as the price of gasoline goes up.<sup>59</sup> Any continuance of the

current program will crowd out funding for technologies and energy sources that may prove to be more efficient as higher production levels absorb available resources. The proposal should state that as the price of gasoline decreases, the subsidy to ethanol would go up to keep it competitively priced for the consumer. As the price of gasoline increases, the subsidy would go down until it would be completely eliminated past a certain break-even point that would allow ethanol to be competitive vis-à-vis gasoline. Domestic petroleum and natural gas already have these types of subsidies. These actions will make ethanol economical while minimizing the disadvantages.

Arguments against phasing out the subsidies will range from, “other countries subsidize their industries,” to “we must protect our family farms,” to “oil and gas companies receive subsidies.” The joint cessation of United States and Brazilian tariffs will make the protectionist arguments moot. Reduced subsidies will keep farmers from overproducing, thus using market forces to naturally drive up the price of corn, without the harmful secondary effects of cropland shift, loss of grasslands, and high overseas grain prices. Finally, ethanol subsidies are substantially more than oil and gas, and, “Two subsidies do not make a fiscal virtue.”<sup>60</sup> Sliding scale subsidies are better politically, fiscally and environmentally.

Beyond these two specific recommendations, government policy should not favor any particular alternative energy source. Historically, governments have done a very poor job of picking the correct industry or product to be the “winner” in the open market. Since tariffs, subsidies to specific programs and targeted R&D programs seem to be counterproductive and a waste of resources, other methods may be better. The

government can devise goals and limitations that encourage alternative energy sources. There are other options that encourage adoption of alternative energy development.

These policy recommendations do not directly impact ethanol, but their adoption would make it a more attractive option. Several think tanks have suggested that the United States adopt the European model of increasing taxes on gasoline to keep demand down, modify behavior and to help fund alternative fuel programs.<sup>61</sup> Instead of driving the cost of ethanol down, they would drive up the cost of gasoline. For example, in Denmark gasoline is \$9 per gallon. Their citizens use public transportation and drive small, alternative energy vehicles. As a result, they went from buying 99 percent of their energy from the Middle East to zero. Meanwhile, Denmark's economy has maintained a steady growth rate.<sup>62</sup> In the United States, higher gasoline prices are a necessary evil to enable alternative fuel programs to succeed.

These types of policies will be politically difficult to implement, because the increased prices will be immediately felt by the majority of the electorate. It is much more politically expedient to provide price supports that most people do not even know about than it is to ask for individual sacrifice to manage our dependence on oil. Therefore, any increase should be implemented in increments to lessen the impact. This will need presidential and congressional leadership to succeed.

If this option is too politically unpalatable, then increasing the tariffs on imported oil may be more acceptable, and accomplish the same purpose. A "security tax" for ensuring the safe passage of Mideast oil would drive up the price of gasoline, making ethanol use more attractive. It would also encourage domestic exploration and

development as prices increase. The drawback of any protectionist tariff is the likelihood of counter tariffs or the embargo on U.S. goods.

Congress should also institute higher fuel economy in vehicles, referred to as Corporate Average Fuel Economy (CAFE) standards.<sup>63</sup> This will drive industry to the development of more fuel efficient vehicles, regardless of the fuel sources used. The arguments for this policy are similar to raising gasoline prices, but raising economy standards are more politically acceptable to the general public, because they see no direct effect upon their daily spendable income. Yet over time individuals will make utility-maximizing decisions that will inevitably lower fuel consumption.

America instituted fuel economy standards in the past, with successful results. Congress imposed the first CAFE standards in 1975, doubling automobile efficiency standards to 27.5 miles per gallon in ten years.<sup>64</sup> However, since that time these standards have barely increased. Vested interests, primarily the auto and oil companies, have influenced Congress to delay increased CAFE standards indefinitely. Once again, it will take savvy political leadership who can shape public opinion to drive Congress to implement this policy.

Third, continue to provide incentives to produce flex-fuel capable automobiles. There are currently six million flex-fuel vehicles on America's highways out of a total of 244 million.<sup>65</sup> Unfortunately, these vehicles are presently filling up with gasoline due to the lack of ethanol infrastructure. Since many of these vehicles have lower gas mileage than a normal car, we are actually adding to our oil use. Therefore, the United States should focus on creating the infrastructure and encouraging the market for E85. This should begin in test areas to evaluate the feasibility of adoption of E85 by consumers,

but lower prices brought on by the relaxation of tariffs should make this possible. The eventual shift to flex-fuel will generate more demand for ethanol. As we move to flex-fuel vehicles, the increased demand for ethanol will make up for the lost income caused by the decrease in tariff protection and subsidies.

Fourth, increase investment in research, development and demonstration of technology that leads us away from oil dependence.<sup>66</sup> For ethanol, R&D efforts need to concentrate on cellulosic ethanol, which seems to be the only economically and environmentally feasible domestic source. Overall, R&D activities must be made to attract more investors, and avoid directed programs that only benefit a specific energy source. A way to accomplish this is through a general tax credit for private research and development. This technique plays to American strength in innovation, and encourages multiple strategies to reach our ultimate energy goals.

Most of these policies will also require action from multiple agencies within the government. These agencies sometimes have conflicting goals. The DOE's Office of Energy Efficiency and Renewable Energy's Biomass Program recognizes this in their Biomass Multi-Year Program. They recognize development responsibilities include the DOA, the Department of Commerce, the EPA, the Department of Transportation, the National Science Foundation, the Department of the Interior, and the Department of Defense. The final policy recommendation is that the DOE be given the clear lead in our energy development programs to synchronize these interagency policymaking stakeholders.

To bundle these policies into a coherent strategy, national leadership is needed. Many of these policy changes will be met with resistance from various groups; from

those vested in our current oil economy to politicians trying to score points against the other party. What we cannot allow to happen is inertia to keep us dependent on oil. The administration can successfully obtain public acceptance by framing these policies in terms of national security. Energy security is complicated and long-term, but simply speaking frankly about what is needed will create good will and unexpected dividends with the public. For example, simply signaling that gasoline prices will slowly begin to increase will cause consumers to modify their behavior. The market will take it from there. Political will and compromise will be needed to make these changes happen.

In summary, current United States protectionist policies are counterproductive and will doom any hope of ethanol becoming a practical replacement for oil, and supporting our need for energy security. If it is to become the fuel of the future, it must stand on its own in the market, and soon. For true energy security, the executive and legislative branches must show leadership by establishing goals and restrictions that will steer the economy toward an alternative energy source. Energy security does not lend itself to easy solutions, and it needs to be clear to the electorate that this will be a long-term, but not impossible process. The present administration can seize the opportunity that the last one missed after 9/11 to convince the American people that this is a national priority, and that there is an obligation that comes with citizenship to make the changes that will ensure our nation's security.

### Endnotes

<sup>1</sup> Energy security is defined as, "the reliable and affordable supply of energy," see "National Security Consequences of U.S. Oil Dependency," *CFR Independent Task Force Report # 58*, 2006, [www.cfr.org/content/publications/attachments/EnergyTFR.pdf](http://www.cfr.org/content/publications/attachments/EnergyTFR.pdf) (accessed December 20, 2008).

<sup>2</sup> Barak H. Obama, *Inaugural Address*, January 21, 2009, [http://www.whitehouse.gov/the\\_press\\_office/President\\_Barack\\_Obamas\\_Inaugural\\_Address/](http://www.whitehouse.gov/the_press_office/President_Barack_Obamas_Inaugural_Address/) (accessed January 22, 2009).

<sup>3</sup> Thomas Friedman, *Hot, Flat and Crowded* (New York: Farrar, Straus and Giroux, 2008), 80.

<sup>4</sup> Martin Hoffert, emeritus professor of physics, New York University, quoted in *Solutions Supplement to National Geographic*, April 2009, 1.

<sup>5</sup> Center for Naval Analyses Military Advisory Board, *Empowering America's Defense: Energy and the Risks to National Security*, May 2009, <http://www.cna.org/documents/PoweringAmericasDefense.pdf> (accessed May 19, 2009).

<sup>6</sup> Andrew J. Bacevich, *The Limits of Power* (New York: Metropolitan Books, 2008), 180.

<sup>7</sup> United States Joint Forces Command, *The Joint Operating Environment 2008* (Norfolk, VA: United States Joint Forces Command Center for Joint Futures, November 25, 2008), 17.

<sup>8</sup> Energy Information Administration, *Persian Gulf Region* (Washington, D.C.: U.S. Department of the Army, 1992), [http://eia.doe.gov/emeu/cabs/Persian\\_Gulf/Background.html](http://eia.doe.gov/emeu/cabs/Persian_Gulf/Background.html) (accessed April 4, 2008).

<sup>9</sup> Daniel Yergin, "Ensuring Energy Security," *Foreign Affairs*, Vol.85, Issue 2, (March/April 2006): 69.

<sup>10</sup> Martin Wolf, "Welcome to the New World of Runaway Energy Demand," *Financial Times*, November 14, 2007, 11.

<sup>11</sup> Yergin, "Ensuring Energy Security," 69.

<sup>12</sup> Jan H. Kalicki, "RX for 'Oil Addiction': The Middle East and Energy Security," *Middle East Policy*, Vol 14, Issue 1 (Spring 2007): 79.

<sup>13</sup> United States Joint Forces Command, *The Joint Operating Environment 2008*, 16.

<sup>14</sup> Seven of the top eight oil exporting nations are: Saudi Arabia, Russia, Iran, Venezuela, Kuwait and Mexico, see CIA World Fact Book, 2006.

<sup>15</sup> Center for Naval Analyses Military Advisory Board, *Empowering America's Defense: Energy and the Risks to National Security*, viii.



<sup>16</sup> Energy Information Administration, *Persian Gulf Region*, January 28, 2008, [http://eia.doe.gov/emeu/cabs/Persian\\_Gulf/Background.html](http://eia.doe.gov/emeu/cabs/Persian_Gulf/Background.html) (accessed April 4, 2008).

<sup>17</sup> Cesar J. Alvarez, "Venezuela's Oil-Based Economy," *Council on Foreign Relations Backgrounder*, February 9, 2009, [http://www.cfr.org/publication/12089/venezuelas\\_oilbased\\_economy.html](http://www.cfr.org/publication/12089/venezuelas_oilbased_economy.html) (accessed February 12, 2009).

<sup>18</sup> Yergin, "Ensuring Energy Security," 69.

<sup>19</sup> Vijay V. Vaitheeswaran, "Oil," *Foreign Policy*, Issue 163 (November/December 2007): 24.

<sup>20</sup> James Brickley, Clifford Smith and Jerold Zimmerman, *Managerial Economics and Organizational Architecture*, (Chicago: Irwin, 1997), 68-70.

<sup>21</sup> Jeff Cox, "Sugar Cane Ethanol's Not-So-Sweet Future," *CNNMoney.com*, August 7, 2008, [http://money.cnn.com/2007/08/06/news/economy/sugarcane\\_ethanol/index.htm](http://money.cnn.com/2007/08/06/news/economy/sugarcane_ethanol/index.htm) (accessed October 1, 2008).

<sup>22</sup> Department of Energy, *Biomass Multi-Year Program Plan*, February 2009, [http://www1.eere.energy.gov/biomass/pdfs/mypp\\_feb2009.pdf](http://www1.eere.energy.gov/biomass/pdfs/mypp_feb2009.pdf) (accessed March 15, 2009), 1-8.

<sup>23</sup> Doug Kaplow, "Biofuels – at What Cost?: Government Support for Ethanol and Biodiesel in the United States," *Global Subsidies Initiative*, October 2006, [www.globalsubsidies.org/files/assets/oecdbiofuels.pdf](http://www.globalsubsidies.org/files/assets/oecdbiofuels.pdf) (accessed September 7, 2008).

<sup>24</sup> Ibid.

<sup>25</sup> Department of Energy, "Annual Energy Outlook 2009," March 2009, [http://www.eia.doe.gov/oiaf/aeo/pdf/0383\(2009\).pdf](http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2009).pdf) (accessed April 20, 2009).

<sup>26</sup> *New Energy for America Plan* (Washington DC: The White House, January 30, 2009), [http://www.whitehouse.gov/agenda/energy\\_and\\_environment](http://www.whitehouse.gov/agenda/energy_and_environment) (accessed February 15, 2009).

<sup>27</sup> Cellulose ethanol is derived from stalks and leaves of plants after the cell walls are broken down through various processes yet to be commercially scalable. There are several low environmental impact grasses that have promise as a fuel sources if this process becomes viable. See Department of Energy, *Biomass Multi-Year Program Plan*, 1-2.

<sup>28</sup> Department of Energy, *Biomass Multi-Year Program Plan*, 1-5.

<sup>29</sup> Joan Glickman, "Working Toward the Renewable Fuel Standard," *Department of Energy*, March 2009, [http://www1.eere.energy.gov/biomass/pdfs/Policy1\\_Glickman.pdf](http://www1.eere.energy.gov/biomass/pdfs/Policy1_Glickman.pdf) (accessed March 25, 2009).

<sup>30</sup> Department of Energy, *American Recovery and Reinvestment Act*, February 17, 2009, <http://www.eere.energy.gov/recovery/> (accessed March 15, 2009).

<sup>31</sup> *Interview of the President by Regional Reporters*, March 11, 2009, [http://www.whitehouse.gov/the\\_press\\_office/Interview-of-the-President-by-Regional-Reporters-3/11/09/](http://www.whitehouse.gov/the_press_office/Interview-of-the-President-by-Regional-Reporters-3/11/09/) (accessed March 20, 2009).

<sup>32</sup> Department of Energy, *Biomass Multi-Year Program Plan*, 1-5.

<sup>33</sup> Vinod Khosla, "The Nexus of Science, Technology, and Foreign Policy Series: Ethanol and Energy Security," *Council on Foreign Relations Transcript*, November 30, 2006, [http://www.cfr.org/publication/12190/nexus\\_of\\_science\\_technology\\_and\\_foreign\\_policy](http://www.cfr.org/publication/12190/nexus_of_science_technology_and_foreign_policy) (accessed January 15, 2009).

<sup>34</sup> Ibid.

<sup>35</sup> *CFR Independent Task Force Report # 58*, 6.

<sup>36</sup> Ethanol is derived from sugar. The U.S. sugar program uses price supports, domestic market allotments, and tariff-rate quotas to control the amount of sugar available. These controls affect all sugars and their byproducts, to include ethanol, See Friedman, *Hot, Flat and Crowded*, 406.

<sup>37</sup> Barak Obama, "A Wonderful Meeting of the Minds," March 16, 2009, <http://www.whitehouse.gov/blog/09/03/14/president-obama-a-wonderful-meeting-of-the-minds/> (accessed March 18, 2009).

<sup>38</sup> Kaplow, "Biofuels – at What Cost?: Government Support for Ethanol and Biodiesel in the United States."

<sup>39</sup> Ibid.

<sup>40</sup> Jeff Cox, "Battle Over Ethanol Benefits," *CNNMoney.com*, July 18, 2007, [http://money.cnn.com/2007/07/18/news/economy/ethanol\\_report/index.htm](http://money.cnn.com/2007/07/18/news/economy/ethanol_report/index.htm) (accessed September 7, 2008).

<sup>41</sup> James Eaves and Stephen Eaves, "Is Ethanol the 'Energy Security' Solution," *CATO Institute*, October 8, 2007, [http://www.cato.org/pub\\_display\\_php](http://www.cato.org/pub_display_php) (accessed September 7, 2008).

<sup>42</sup> Anne Trafton, "MIT Experts Foresee Sustainable Ethanol Production," *Massachusetts Institute of Technology News Office*, February 8, 2007,

<http://web.mit.edu/newsoffice/2007/print/biofuels-print.html>; (accessed September 7, 2008).

<sup>43</sup> Eaves and Eaves, "Is Ethanol the 'Energy Security' Solution."

<sup>44</sup> Cox, "Battle Over Ethanol Benefits."

<sup>45</sup> The two estimates are from studies conducted by Khosla Ventures and The Rocky Mountain Institute, see Khosla, "The Nexus of Science, Technology, and Foreign Policy Series: Ethanol and Energy Security."

<sup>46</sup> Ibid.

<sup>47</sup> Cox, "Battle Over Ethanol Benefits."

<sup>48</sup> Nancy Stauffer, "MIT Ethanol Analysis Confirms Benefits of Biofuels," *Massachusetts Institute of Technology News Office*, January 8, 2007, <http://web.mit.edu/newsoffice/2007/print/ethanol-print.html> (accessed February 7, 2009).

<sup>49</sup> Car companies designed flex fuel vehicles to run on various fuels; from regular gasoline up to an 85% ethanol blend. The current generation of flex fuel vehicles have lower gas mileage than the standard vehicle fleet due to designs that allow them to run on the 85% ethanol blend.

<sup>50</sup> Department of Energy, "Biomass Multi-Year Program Plan," 1-9.

<sup>51</sup> Khosla, "The Nexus of Science, Technology, and Foreign Policy Series: Ethanol and Energy Security."

<sup>52</sup> *CFR Independent Task Force Report # 58*, 5.

<sup>53</sup> U.S. Government Accountability Office, *Advanced Energy Technologies: Key Challenges to Their Development and Deployment* (Washington, D.C.: U.S. Government Accountability Office, February 2007), 4, <http://www.gao.gov/products/GAO-07-550T> (accessed September 7, 2008).

<sup>54</sup> Eaves and Eaves, "Is Ethanol the 'Energy Security' Solution."

<sup>55</sup> Nicholas Loris, "2009 Energy Bill: Anti-Market and Anti-Consumer," *The Heritage Foundation*, March 31, 2009, <http://www.heritage.org/Research/EnergyandEnvironment/wm2378.cfm> (accessed April 22, 2009).

<sup>56</sup> *CATO Handbook for Policymakers*, 7<sup>th</sup> Edition, 2009, 461, [www.cato.org/pubs/handbook/](http://www.cato.org/pubs/handbook/) (accessed December 30, 2008).

<sup>57</sup> Ronald Steenblik, ed., “Biofuels – at What Cost?,” *Global Subsidies Initiative*, September 2007, [www.globalsubsidies.org/files/assets/oecdbiofuels.pdf](http://www.globalsubsidies.org/files/assets/oecdbiofuels.pdf) (accessed September 7, 2008).

<sup>58</sup> Cox, “Battle Over Ethanol Benefits.”

<sup>59</sup> Kaplow, “Biofuels – at What Cost?: Government Support for Ethanol and Biodiesel in the United States.”

<sup>60</sup> Ibid.

<sup>61</sup> *CFR Independent Task Force Report # 58*, 2006, 6.

<sup>62</sup> Friedman, *Hot, Flat and Crowded*, 18.

<sup>63</sup> *CFR Independent Task Force Report # 58*, 2006.

<sup>64</sup> Friedman, *Hot, Flat and Crowded*, 16.

<sup>65</sup> Steenblik, “Biofuels – at What Cost?”

<sup>66</sup> *CFR Independent Task Force Report # 58*, 2006, 7.

